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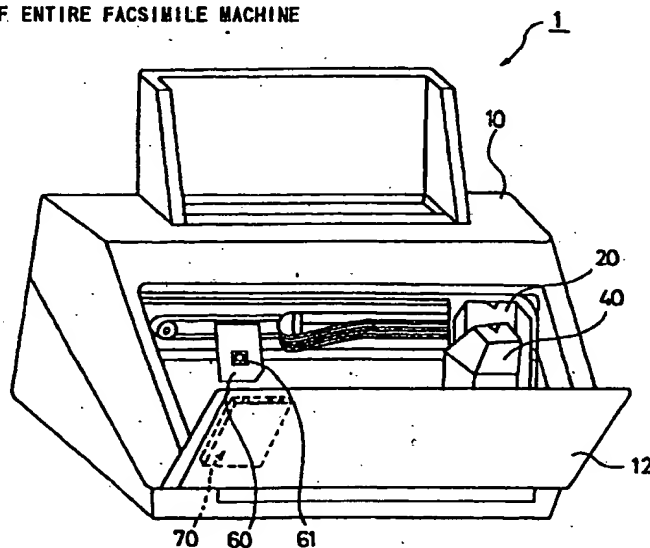
**(54) Printing apparatus provided with inkjet printer**

(57) A printing apparatus (1) which includes an inkjet printer (20) uses an ink cartridge (40) accompanied by an IC card (60) to which an IC chip having a read only memory and a read/write memory is secured. A control signal for starting the operation of the inkjet printer is stored in the read only memory, and information indicative of a final printing date/time of the inkjet printer is updated and stored in the read/write memory. Since the inkjet printer starts its operation in response

to only the operation starting control signal, it is possible to eliminate nonconforming articles from ink cartridges which are expendable supplies. Furthermore, the printing apparatus is capable of maintaining the state of emission of ink in good conditions by operating the inkjet printer to effect printing in a predetermined format each time a predetermined time elapses from a stored final printing date/time.

**FIG.1**

**VIEW OF ENTIRE FACSIMILE MACHINE**



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## Description

### Background of the Invention:

- [0001] The present invention relates to a printing apparatus provided with an inkjet printer, such as a printer or a facsimile machine to which ink is supplied from an ink cartridge.
- [0002] An inkjet printer is used as a printer for a facsimile machine, a copying machine or computer equipment. The inkjet printer is arranged to perform printing by emitting a pressurized ink from a small hole called a nozzle toward a sheet surface while moving a head over the sheet surface from left to right and back.
- [0003] In a printer such as a printer which serves as an output part of computer equipment or a printer incorporated in a copying machine, printing is performed with the above-described type of inkjet printer.
- [0004] The inkjet printer is divided into a piezoelectric type which forces ink out of the nozzle by using a piezoelectric element which is deformed due to a variation in voltage and a bubble inkjet type which ejects ink by creating a bubble with a heater and applying pressure to the ink.
- [0005] In such an inkjet printer, since the speed of printing greatly depends on the time required to dry ink ejected and deposited on a sheet surface, a quick-drying ink is used to cope with high-speed printing.
- [0006] This ink is normally contained in an ink cartridge provided with part of an ink forcing control mechanism or in an ink cartridge to be separately mounted on the ink forcing control mechanism. In general, if an ink cartridge is out of ink, the ink cartridge itself is exchanged with a new ink cartridge.
- [0007] The printing apparatus provided with the above-described type of inkjet printer has several problems which will be described later.
- [0008] The first problem resides in the method of eliminating nonconforming ink cartridges.
- [0009] Conventionally, to maintain the conformity of ink cartridges which are expendable supplies, uneven patterns have been structurally formed to prevent the use of nonconforming ink cartridges, or such conformity has been checked by reading an identification mark such as an optical bar code.
- [0010] However, the formation of such uneven patterns has the problem of being unable to offer useful means for eliminating a nonconforming ink cartridge, in part because a portion at which the uneven patterns can be formed is determined by the structure of the apparatus or in part because similar uneven patterns can be easily formed.
- [0011] In the case of checking the conformity of an ink cartridge by reading identification information from the ink cartridge itself or data attached thereto, if optical information such as a bar code is used, the optical information will allow easy duplication with a copying machine and also illegal modification of its information contents. As a result, a nonconforming ink cartridge can be easily used. Accordingly, the optical identification information is unable to offer useful means for eliminating nonconforming ink cartridges.
- [0012] The second problem resides in the method of maintaining the state of printing in good conditions even after a long-time nonuse of the inkjet printer.
- [0013] The inkjet printer is provided with a cleaning mechanism which hermetically closes a nozzle portion when no printing is performed, and cleans the surface of the nozzle portion or sucks ink from the nozzle portion at the time of start of printing.
- [0014] However, in the inkjet printer, since a quick-drying ink is used and the ink easily dries at the nozzle portion, there is the problem that if the inkjet printer is not used for a long time (several days to one or more weeks) during a long vacation such as a vacation at the end or the beginning of the year or a summer vacation, an ink ejection portion is clogged and no good printing can be effected after such long-time nonuse.
- [0015] In other words, clogging which occurs after long-time nonuse, i.e., ink dried during a long time, cannot be eliminated with only the cleaning mechanism, and if printing is not performed for a long time, the ink ejection portion of an ink cartridge cannot be maintained in good conditions at all times.
- [0016] The third problem resides in the method of managing a remaining ink volume.
- [0017] In many remaining-ink-volume management methods, when an ink cartridge is exchanged, a counter for counting the number of pages printed or the ink volume used is initialized in a controller of the printing apparatus, and each time a print job is executed, the counter counts the ink volume used. If the ink volume used reaches a predetermined warning ink volume, a warning is displayed, and if the ink volume used reaches an out-of-ink volume, the printer function of the printing apparatus is stopped.
- [0018] However, this method merely performs initialization at the time of exchange of an ink cartridge and has the problem that if the ink cartridge is removed once for the purpose of troubleshooting, inspection or the like, initialization is performed in spite of a small remaining ink volume and the ink cartridge is set to its initial use state, or the ink cartridge is regarded as a used ink cartridge and becomes unable to be re-used.
- [0019] Even if a facsimile machine fails, the ink cartridge mounted in the facsimile machine which is out of order cannot be transferred to and re-used in a new facsimile machine.
- [0020] In other words, the management of the remaining ink volume of an ink cartridge is only valid at the time of the first exchange, and has the problem that if the ink cartridge is removed at an intermediate time, it is impossible to appropriately perform management of the remaining ink volume.
- [0021] The fourth problem resides in the method of providing information to customers.

**[0022]** Although the printing apparatus is accompanied by a document which describes an instruction manual, a maintenance service network, an office to receive orders for expendable supplies and the like for the convenience of a customer, the customer only reads the document when he starts to use the printing apparatus, and seldom places the document near the printing apparatus.

**[0023]** Although information indicative of a service office for troubleshooting or an office to receive orders for exchanges is described on the package of a new ink cartridge, the package is often disposed of before the ink cartridge is exchanged.

**[0024]** This leads to the problem that when the ink cartridge fails or is to be exchanged, the required document must be looked for and a time-consuming operation is needed to search for the necessary information.

**[0025]** In addition, even if the document is attached to the printing apparatus or is prepared on the side of the printing apparatus, a user needs to perform an awkward operation to replace the contents of the document with the latest information, and if the user makes no effort to obtain the latest information, the user behaves on the basis of old information and encounters the problem of being unable to easily use a maintenance service network or an order service network.

#### Brief Summary of the Invention:

**[0026]** The present invention has been made to solve the above-described problems, and its first object is to provide an inkjet printer apparatus and a facsimile machine provided with an inkjet printer which are capable of eliminating nonconforming articles from ink cartridges which are expendable supplies.

**[0027]** A second object of the present invention is to provide a printing apparatus provided with an inkjet printer, which is capable of maintaining the state of ejection of ink in good conditions at all times even during a long nonuse interval.

**[0028]** A third object of the present invention is to provide a printing apparatus provided with an inkjet printer, which is capable of reliably performing management of a remaining ink volume.

**[0029]** A fourth object of the present invention is to provide a printing apparatus provided with an inkjet printer, which is capable of providing the latest information to a user.

**[0030]** A printing apparatus provided with an inkjet printer to achieve the above and other objects has the following construction.

**[0031]** A printing apparatus according to the present invention is an apparatus which includes an inkjet printer and is arranged to supply an ink for the inkjet printer from an exchangeable ink cartridge. This printing apparatus comprises an interface provided in the printing apparatus, for reading information from an IC chip secured to an IC card which accompanies the

ink cartridge, the IC chip having a read only memory and a read/write memory. A control signal for starting an operation of the inkjet printer is stored in the read only memory, and information indicative of a final printing date/time of the inkjet printer is stored in the read/write memory. The printing apparatus is controlled to start the inkjet printer when reading the control signal from the read only memory. In addition, when a predetermined time elapses from the final printing date/time read from the read/write memory, the printing apparatus is controlled to operate the inkjet printer to perform printing in a predetermined format, and update the final printing date/time of the read/write memory.

**[0032]** Otherwise, the IC chip is secured to not the IC card but the ink cartridge. More specifically, a printing apparatus according to the present invention is an apparatus which includes an inkjet printer and is arranged to supply an ink for the inkjet printer from an exchangeable ink cartridge. The printing apparatus comprises an interface provided in the printing apparatus, for reading information from an IC chip secured to the ink cartridge, the IC chip having a read only memory and a read/write memory. A control signal for starting an operation of the inkjet printer is stored in the read only memory, and information indicative of a final printing date/time of the inkjet printer is stored in the read/write memory. The printing apparatus is controlled to start the inkjet printer when reading the control signal from the read only memory. In addition, when a predetermined time elapses from the final printing date/time read from the read/write memory, the printing apparatus is controlled to operate the inkjet printer to perform printing in a predetermined format, and update the final printing date/time of the read/write memory.

**[0033]** According to the printing apparatus provided with the inkjet printer having the above-described construction, it is possible to achieve the following effects.

**[0034]** Since the control signal for starting the operation of the printer is stored in the read only memory of the IC card or the IC chip incorporated in the ink cartridge, it is possible to prevent use of a nonconforming cartridge, and it is also possible to prevent printing troubles from occurring when printing is performed with an inappropriate ink cartridge mounted on the printer.

**[0035]** In addition, since the control signal for starting the operation of the printer is stored in the read only memory, the forgery of the control signal is difficult. Furthermore, by encoding the control signal, it is possible to readily make decoding far more difficult.

**[0036]** Since information indicative of the last printing date/time is stored in the read/write memory of the IC chip incorporated in the IC card or the ink cartridge, it is possible to readily realize in the printer the control of reading the information and counting an elapsed time from the read last printing date/time, and producing a printout in a predetermined format when the elapsed time exceeds a predetermined time.

**[0037]** In addition, since the information indicative

of the last printing date/time is updated at appropriate timing and is stored in the IC chip which can be moved together with the ink cartridge, the information is moved together with the ink cartridge so that test printing can be performed periodically and automatically. Accordingly, it is possible to maintain the ink ejection portion of the ink cartridge in good conditions at all times, and it is possible to maintain the state of printing of the printer in good conditions at all times.

[0038] The above-described printing apparatus including the inkjet printer further comprises consumed-ink-volume detecting means for detecting a consumed ink volume relative to a print job, and remaining-ink-volume detecting means for detecting a remaining ink volume of the ink cartridge mounted on the inkjet printer from the consumed ink volume detected by the consumed-ink-volume detecting means. The printing apparatus is arranged to update the read/write memory and store in the read/write memory the remaining ink volume detected by the remaining-ink-volume detecting means; the remaining ink volume varying with the print job of the printing apparatus, and issue a warning when the remaining ink volume becomes smaller than a predetermined ink volume, and then stop the printer after causing the printer to perform a predetermined quantity of printing.

[0039] This warning is a display or sound which requests the user to supply ink, i.e., exchange ink cartridges, and the predetermined amount is normally set to a print quantity of 50 pages or more.

[0040] According to the printing apparatus provided with the inkjet printer having the above-described construction, information indicative of the latest remaining ink volume of the ink cartridge is updated and stored in the read/write memory of the IC chip incorporated in the IC card or the ink cartridge, it is possible to optimally manage the ink volume of the ink cartridge.

[0041] More specifically, since the information indicative of the remaining ink volume is stored not in the printing apparatus but in the IC chip of the IC card or the ink cartridge and can be moved together with the ink cartridge, even if the ink cartridge in which an available amount of ink remains is exchanged or the printing apparatus is exchanged, it is possible to grasp an optimum remaining ink volume at all times. Accordingly, it is possible to prevent troubles such as execution of printing in an out-of-ink state or display of an instruction to exchange an ink cartridge having a sufficient remaining ink volume.

[0042] In the printing apparatus including the inkjet printer having the above-described construction, information indicative of an operation guide for the printing apparatus and setup information for at least one of the printing apparatus and the inkjet printer are stored in the read only memory of the IC chip.

[0043] By inserting the IC card into the IC card interface or mounting the ink cartridge, it is possible to start the operation of the printer, and it is also possible

to provide accurate control and the latest information on the basis of the information indicative of the operation guide and the setup information. In particular, since the information can be easily obtained when the ink cartridge is exchanged, no user needs to look for and refer to a manual.

[0044] In the above-described printing apparatus including the inkjet printer, at least one kind of information for each individual customer is stored in the read only memory of the IC chip, the at least one kind of information being selected from among language selection information, control information as to a machine operation such as setup which conforms to standards of each country, an instruction manual of the printing apparatus, service information as to expendable supplies, and guidance information as to a maintenance service network.

[0045] Since the information for each individual customer is previously stored, it is possible to provide accurate control and the latest information which can meet the request of each customer, on the basis of detailed information for each individual customer.

[0046] In the above-described printing apparatus provided with the inkjet printer, information exclusive to a customer, which includes at least either information representative of a relation between offices with which the customer communicates and their shortened telephone numbers or an emergency telephone number for the customer, is stored in the read/write memory.

[0047] Since the information exclusive to the customer is stored in the read/write memory, a supply side of the ink cartridge can keep and manage the information which the customer easily forgets, if the customer has only to send back the IC card secured to the ink cartridge or the IC card, after the exchange of the ink cartridge. Accordingly, the supply side can keep and manage the information instead of the customer.

[0048] In addition, the printing apparatus is a facsimile machine and, when the control signal for starting the operation of the inkjet printer is not inputted from the read only memory, stops only a printer function and maintains the transmission function of the facsimile machine without stopping the transmission function.

[0049] According to this construction, even if a non-conforming ink cartridge is used, it is not necessary to stop the transmission function of the facsimile machine which uses no ink, whereby it is possible to efficiently use the facsimile machine.

[0050] Accordingly, in the printing apparatus provided with the inkjet printer according to the present invention, printing information such as information indicative of a final printing date/time or a remaining ink volume which varies with the operation of the printer or the printing apparatus is written into or read from the read/write memory of the IC chip incorporated in the IC card or the ink cartridge, whereby updated information is stored in the IC chip. Accordingly, it is possible to grasp the latest state of the ink cartridge at all times,

and it is possible to effect operations such as maintenance of the printer function through automatic and periodical test printing, display of an out-of-ink warning, and stoppage of the printer during an out-of-ink state.

[0051] Furthermore, since the latest information for each individual customer is stored in the read/only memory of the IC chip incorporated in an IC card or an ink cartridge and can be delivered to each customer together with the ink cartridge, the latest information can be provided to the customers.

[0052] In addition, data peculiar to a customer can be stored in the read/write memory of the IC chip incorporated in an IC card or an ink cartridge, at the desire of the customer, and this IC card can be moved together with the ink cartridge. Accordingly, even if the printing apparatus provided with a printer is exchanged, the data can be transferred without problem.

[0053] Further objects, features and advantages of the present invention will be more fully understood from the following description.

#### Brief Description of the Drawings:

[0054]

Fig. 1 is a view showing the entire facsimile machine provided with an inkjet printer according to the present invention;

Fig. 2 is a block diagram of the facsimile machine;

Fig. 3 is a perspective view of an ink cartridge;

Fig. 4 is a perspective view of the printer on which to mount the ink cartridge;

Fig. 5 is a perspective view showing an IC card interface through which to input/output data of an IC card according to the present invention;

Fig. 6(a) is an exploded view of the IC card interface of Fig. 2 as viewed from diagonally above, with an IC card inserting slot being visible;

Fig. 6(b) is an exploded view of the IC card interface of Fig. 2 as viewed from diagonally below, with the IC card inserting slot being visible;

Fig. 7 is a circuit diagram of the interface of Fig. 2;

Fig. 8 is a flowchart of an IC card system, showing the operation flow of the printing apparatus provided with the inkjet printer according to the present invention;

Fig. 9 is a flowchart of a process A of Fig. 8;

Fig. 10 is a flowchart of a process B of Fig. 8; and

Fig. 11 is a flowchart of a process C of Fig. 8.

#### Detailed Description of the Invention:

[0055] A preferred embodiment of a printing apparatus provided with an inkjet printer according to the present invention will be described below with reference to the accompanying drawings.

[0056] Fig. 1 shows a facsimile machine 1 having an inkjet printer. As shown in Fig. 1, a printer 20 is

located inwardly of a front panel 12 of a facsimile body 10; and an ink cartridge 40 is mounted on the printer 20. An interface 70 for an IC card 60 is provided on the reverse surface of the front panel 12.

[0057] As shown in Fig. 2, the printer 20 is incorporated in a part of the facsimile body 10, and is provided with the IC card interface 70 to write or read information to or from an IC card which is delivered together with an ink cartridge in the state of being attached thereto. A printer board unit 22 is connected to the printer 20.

[0058] The facsimile body 10 is coupled to a cover switch 12, a paper sensor 13, a scanner motor and others all of which serve to read a document to be transmitted. Also connected to the facsimile body 10 are a keyboard unit 15, a handset control unit 16 to be coupled to a handset 17, and a network control unit 18. In addition, a speaker 19, a power supply unit 30 and others are connected to the facsimile body 10.

[0059] The ink cartridge 40 for use with the inkjet type of printer 20 of the facsimile body 10 has a form such as that shown in Fig. 3. This ink cartridge 40 has an ink tank in its interior, and a multiplicity of nozzles 42 from which to emit ink are opened in a bottom 41 of the ink cartridge 40. A circuit board 44 for nozzle control is disposed to extend over the nozzles 42, the bottom 41 and a side 43. If the ink cartridge 40 is mounted at a predetermined position of the printer 20, a connecting portion 44b of a wiring portion 44a of the circuit board 44 is coupled to a wiring portion of the printer 20, whereby the printer 20 becomes able to control the nozzles 42 as well as pressurization of ink.

[0060] The printer 20 on which the ink cartridge 40 is mounted effects printing while moving a cartridge carrier 51 in directions A and B as viewed in Fig. 4 by means of a drive belt 53 driven by a motor 52. A cartridge carrier 51 is provided with a guide rod 55a and a strip-shaped guide band 55b so that the guide rod 55a and the strip-shaped guide band 55b guide the cartridge carrier 51 to enable smooth and accurate movement of the cartridge carrier 51.

[0061] A wire harness 56 having a connector 56a extends into a connecting portion 56b of a carrying surface 51a of the cartridge carrier 51, and if the ink cartridge 40 is mounted, the connecting portion 56b is brought into contact with the connecting portion 44b to provide electrical connection therewith.

[0062] A cleaning portion 57 is provided at one end of the printer 20. While no printing is being executed, the ink cartridge 40 is placed in a standby state at the cleaning portion 57, and during standby, the cleaning portion 57 covers the nozzles 42 to prevent drying of ink. At the starting time of each printing, ink is sucked from all the nozzles 42 by the cleaning portion 57 so that good emission of ink from the nozzles 42 can be effected.

[0063] As shown in Figs. 5 and 6, the IC card interface (card reader/writer) 70 includes a base member 71, a circuit board 72 and a lid member 73. The circuit

board 72 is disposed at a location set back from insertion slots 71a and 73a which are formed between the base 71 and the lid 73, and is arranged so that when the IC card 60 is inserted into the insertion slots 71a and 73a, an acceptor 72a of the circuit board 72 can be opposed to an IC chip 61 of the IC card 60 to enable inputting/outputting of data.

[0064] As shown in Fig. 7 which schematically illustrates the circuit of the circuit board 72, the circuit board 72 has the acceptor 72a and a header 72b as well as a circuit for reading data from the IC card 60.

[0065] As shown in Figs. 4 and 6, similarly to a normal IC card, the IC card 60 is produced by embedding an extremely small and thin IC (Integrated circuit) chip 61 into a plastic card 65, and the IC chip 61 is formed of a read only memory 62 and a read/write memory 63.

[0066] Each ink cartridge 40 is accompanied by one IC card 60, and the IC card 60 is put on or separately attached to the ink cartridge 40 so that the IC card 60 can work with the ink cartridge 40 at all times. When the ink cartridge 40 is mounted on the printer 20, as shown in Fig. 1, the IC card 60 is inserted into the IC card interface 70 which is mounted on the reverse surface, i.e., the inside surface, of the front panel 12. If the ink cartridge 40 is exchanged for a new one, the IC card 60 is also exchanged for a new IC card 60 with which the new ink cartridge 40 is provided.

[0067] As another example, as shown by dashed lines in Fig. 3, an IC chip 61A may be incorporated not into an IC card but into a part of the ink cartridge 40. This incorporation method allows easy management because the ink cartridge 40 and the IC chip 61A having a read only memory 62A and a read/write memory 63A work integrally at all times, but requires an IC chip incorporating process.

[0068] Information such as that described below is previously stored in the read only memory 62A of the IC chip 61 which is incorporated in the IC card 60 or the ink cartridge 40.

#### 1) Printer Control Information

[0069] This information serves to start the operation of the printer of a customer and is an operation start command signal. The information plays the role of a key. By complicating or encoding the information, it is possible to prevent a nonconforming ink cartridge from being used.

#### 2) ID Information

[0070] This information contains the ID (identification code) of a facsimile machine and the ID of the customer, and is used to determine whether an ink cartridge is available to the facsimile machine and the customer.

#### 3) Quick User Guide Information

[0071] This information represents an operating manual of the facsimile machine.

[0072] User guide information is usually provided to the customer together with the facsimile machine in the form of a handbook. Usually, handbooks need not be referred to at all times and are placed at locations away from the facsimile machines of users, so that users cannot readily obtain the desired information, such as the information required for exchange of ink cartridges, at the desired time. To solve this problem, such user guide information is stored in the IC chip 61, and during exchange of the ink cartridge 40, this user guide information is automatically displayed as a user operation guide when the IC chip 61 is opposed to the reader of the IC card interface 70.

[0073] The user guide information can also be displayed by an operation at an operating panel even during any operation other than the exchange of the ink cartridge 40.

#### 4) Language Selection Information

[0074] This information relates to a language to be used (such as Japanese, English or French). If the market for facsimile machines is international, difficult languages (such as Japanese, English and French) are used. When information such as an operating guide or trouble information is displayed, an operation executed on a system side is displayed in a language designated by language designation information stored on an IC card.

#### 5) Country Setup Information

[0075] This information copes with setup operations which differ among different countries, and is previously inputted in accordance with a demand from a market area or a customer so that the operation required for setup can be simplified.

#### 6) Service Network Information

[0076] This information relates to a machine maintenance service network for maintenance or troubleshooting, and is displayed after being read from the IC chip 61, as required.

#### 7) Ink Order Information

[0077] This information contains information such as the telephone and facsimile numbers of offices to receive orders for ink cartridges and the names of the offices, and is displayed together with a warning display which warns a decrease in ink volume, when the remaining ink volume becomes small.

## 8) Telephone Number Information

**[0078]** This information serves to store data such as data representative of the relation between offices with which a user communicates and their shortened telephone numbers, and an emergency telephone number for the user.

**[0079]** This information makes it possible to omit the operation required to re-input data, when facsimile machines are exchanged.

**[0080]** In the read/write memory 63 incorporated in the IC card 60 or the ink cartridge 40, the following information is updated on the basis of the previously inputted initial information, in accordance with the operation of the facsimile body 10.

### 1) Remaining Ink Volume Information

**[0081]** This information is the latest information indicative of the remaining ink volume of the ink cartridge 40. The facsimile body 10 calculates an actually consumed ink volume from an ink volume which remains in the ink cartridge 40 when the ink cartridge 40 and the IC card 60 are changed, and subtracts the ink volume obtained as the result of this calculation from the initial ink volume, and updates the remaining ink volume.

**[0082]** If this remaining ink volume becomes small, an ink volume warning is displayed on a display portion of the printer 20 or the facsimile body 10 having a printer.

**[0083]** The calculation of the remaining ink volume is performed by counting a consumed ink volume not from the number of sheets printed but on the basis of the control of ink nozzles, whereby a consumed ink volume can be managed with high precision.

### 2) Automatic Test Print Information

**[0084]** This information represents the date/time of the last printing.

**[0085]** If an inkjet printer does not perform printing for a long time, its ink will dry and the nozzle portion of the printer will be easily clogged. The information is intended to cause the printer to perform test printing automatically and periodically at predetermined time intervals, thereby preventing the nozzle portion from being clogged with ink.

**[0086]** More specifically, the last printing date/time is inputted into the IC chip 61, and the facsimile body 10 periodically compares the last printing date/time of the IC chip 61 with the current date/time. If the facsimile body 10 detects that a predetermined time (for example, three days or one week) has elapsed, the facsimile body 10 prints out a reception report or a test chart and updates the last printing date/time at the same time, and then repeats the above-described operation. Specifically, test printing for preventing clogging with ink is

repeated, for example, every third day or once a week.

## 3) Telephone Number Information

**[0087]** This information is similar to the telephone number information stored in the read only memory 62, but a storage location for storing the telephone number information is also prepared in the read/write memory 63 of the IC chip 61 so that updated information can be stored in the IC chip 61. By storing the updated information in the IC chip 61, it is possible to omit the operation required to re-input data, when the facsimile machine 1 is replaced due to a failure of the facsimile body 10 or the like.

**[0088]** The flow of the operation of the facsimile machine 1 provided with the inkjet printer using the IC chip 61 will be described with reference to the flowchart shown in Fig. 8.

**[0089]** First, if the on state of the power supply is detected in Step S10, the apparatus is initialized in Step S11. Then, in a process A of Step S12, an operation starting control signal, a machine code, a customer code and a remaining ink volume are inputted, and in Step S13, the IDs (identification codes) are validated in Step S13.

**[0090]** If the operation starting control signal is inputted and the result of the validation of the IDs such as the machine code and the customer code is OK, the process proceeds to an idle mode of Step S20. If the result of the validation is NO, the printer 20 is stopped and an error display is provided.

**[0091]** While the process is waiting in the idle mode of Step S20, a check is made as to an incoming call (Step S21), an automatic timer (Step S22), a panel operation (Step S23), transfer of data (Step S24), and whether a cover is open (Step S25).

**[0092]** If an incoming call is received in Step S21, the process proceeds to voice communication (Step S16) or to facsimile communication (Step S31) and a process B (a check as to a remaining ink volume) (Step S48), on the basis of a decision made in Step S30.

**[0093]** If the operation of the automatic timer is started, the process proceeds to Step S32 on the basis of the decision made in Step S22, and executes automatic facsimile transmission (Step S33), automatic facsimile reception (Step S35) or automatic copy printing (Step S37) on the basis of a decision made in Step S32, Step S34 or Step S36, and then proceeds to the process B (Step S48).

**[0094]** If a panel operation is performed, the process proceeds to Step S40 on the basis of the decision made in Step S23, and executes copy printing (Step S43) if it is determined in Step S42 that copy printing has been selected, or copy printing (Step S45) if it is determined in Step S44 that a data change has been selected, or facsimile communication (Step S47) if it is determined in Step S46 that facsimile transmission has been selected. Then, the process proceeds to the proc-



ess B (Step S48).

[0095] If the panel operation indicates voice communication (Step S41) but does not indicate the copy printing, the data change nor the facsimile communication, the process returns to the idle mode (Step S20).

[0096] If the panel operation is not performed in Step S23, the process proceeds to Step S24, in which it is determined whether the transfer of data between the IC card and the system memory is needed. If the transfer of data is needed, the process proceeds to a process C of Step S26 (transfer of data), in which the transfer of data between both is executed. Then, the process returns to the idle mode (Step S20).

[0097] If the transfer of data is not needed, the process proceeds to Step S25, in which a check is made as to whether the cover is open. If the cover is open, the process returns to the initialization of Step S11.

[0098] If the process B of Step S48 is finished, it is determined in Step S49 whether the current ink volume is less than an ink volume represented by a low ink mark. If the current ink volume is greater than the ink volume represented by the low ink mark, the process returns to the idle mode (Step S20). If the current ink volume is less than the ink volume represented by the low ink mark, the process proceeds to Step S50, in which it is determined whether the ink cartridge is out of ink. If the ink cartridge is out of ink, the process proceeds to Step S14, in which the printer 20 is stopped and an error display is provided. If the ink cartridge is not out of ink, a display indicative of a low ink volume is provided in Step S51, and the process returns to the idle mode (Step S20).

[0099] The process A, the process B and the process C will be described below in more detail.

[0100] The process A has the flow shown in Fig. 9. In Step A10, the data of the IC card, a page count memory PgM, a machine code McC and a customer code CcC are transferred to the system memory.

[0101] Then, in Step A11, the machine code McC and the customer code CcC are validated, and if they are not valid, a display indicative of cartridge error is provided in Step A14 and, in Step A15, a printer function is disabled to inhibit printing.

[0102] If the machine code McC and the customer code CcC are validated in Step A11, it is determined whether the ink volume stored in the page count memory PgM is smaller than that represented by the low ink mark and that represented by an out of ink mark. If the answer is YES, the process proceeds to Step A14 and Step A15, in which a display indicative of cartridge error is provided and the printer function is disabled.

[0103] In addition, if the machine code McC and the customer code CcC are validated and the ink volume stored in the page count memory PgM is greater than either of the ink volumes represented by the low ink mark and the out of ink mark, the process proceeds to the idle mode.

[0104] The process B has the flow shown in Fig. 10.

In Step B10, it is determined whether a copy printout process has been executed. If the answer is NO, the process proceeds to Step B11, in which the IC card is updated with the latest consumption statistic data.

[0105] In Step B12, a consumed ink volume relative to the number of pages is calculated by consumed-ink-volume detecting means for detecting a consumed ink volume relative to a print job. This calculation is performed by subtracting the number of pages printed during one page job, Pp, from the number of available pages, Pg, in a subroutine A.

[0106] After this calculation, in Step B13, the data is transferred from the system memory to the IC chip 61 by remaining-ink-volume detecting means, and the contents of the page count memory PgM are replaced with the number of available pages, Pg. Specifically, the remaining ink volume of the ink cartridge 40 mounted on the printer 20 is detected from the consumed ink volume detected by the consumed-ink-volume detecting means, and the stored contents of the read/write memory 63 of the IC chip 61 are updated with the remaining ink volume which varies with the print job of the printing apparatus, the remaining ink volume being detected by the remaining-ink-volume detecting means.

[0107] In Step B14 and Step B15, it is determined whether the ink volume stored in the page count memory PgM is smaller than the ink volume represented by the low ink mark or the out of ink mark. If the answer is YES, a display indicative of cartridge error is provided in the process B, and in Step B17, the printer function is disabled to inhibit printing.

[0108] Then, the process returns to the idle mode.

[0109] The process C has the flow shown in Fig. 11. After a user interface routine of Step C10, it is determined in Step C11 whether to select "no selection". If "no selection" is not selected, the process proceeds to the idle mode.

[0110] If "no selection" is selected in Step C11, it is determined in Step C12 whether to execute reading from the IC card. If reading is to be executed, selected data of the IC card is transferred to and stored in the system memory in Step C13.

[0111] If it is determined in Step C12 that no reading from the IC card is executed, it is determined in Step C14 whether to execute writing to the IC card. If writing is to be executed, selected data is transferred to and stored in the IC card from the system memory in Step C15.

[0112] After the transfer of the data between the IC card and the system memory has been completed, the process returns to the user interface routine of Step C10.

[0113] The flow of the operation of the facsimile machine 1 having the inkjet printer is as described above.

[0114] The facsimile machine provided with the inkjet printer having the above-described construction is capable of serving the following effects.



[0115] Since a control signal for starting the operation of the printer 20 is stored in the read only memory 62 of the IC card 60 or the IC chip 61 incorporated in the ink cartridge 40, even if a nonconforming cartridge 40 is to be used with the ink cartridge 40, the printer 20 cannot receive such control signal and start its operation.

[0116] Accordingly, the IC card 60 or the ink cartridge 40 having the IC chip 61 in which a correct control signal is stored is needed. For this reason, since a proper ink cartridge 40 needs to be used, it is possible to prevent use of a nonconforming ink cartridge 40. Consequently, it is possible to prevent printing troubles from occurring when printing is performed with an inappropriate ink cartridge 40 mounted on the printer 20.

[0117] In addition, since the control signal for starting the operation of the printer 20 is stored in the read only memory 62, the forgery of the control signal is difficult. By encoding the control signal, it is possible to readily make decoding far more difficult.

[0118] Since information indicative of the last printing date/time is stored in the read/write memory 63 incorporated in the IC chip 61 incorporated in the IC card 60 or the ink cartridge 40, the facsimile body 10 counts an elapsed time from the read last printing date/time, and can print out a reception report or a test chart, for example, every third day or once a week. In addition, since the information indicative of the last printing date/time can be moved together with the ink cartridge 40, even if the ink cartridge 40 is mounted in a different facsimile body 10, the different facsimile body 10 can be made to perform test printing periodically and automatically. Accordingly, the ink emission portion of the ink cartridge 40 can be held in good conditions at all times, and the state of printing of the printer 20 can be maintained in good conditions.

[0119] Since information indicative of the latest remaining ink volume of the ink cartridge 40 is updated and stored in the read/write memory 63 of the IC chip 61 incorporated in the IC card 60 or the ink cartridge 40, it is possible to optimally manage the ink volume of the ink cartridge 40. In particular, since the information indicative of the remaining ink volume is stored not in the facsimile body 10 but in the IC chip 61 of the IC card 60 or the ink cartridge 40, the information indicative of the remaining ink volume can be moved together with the ink cartridge 40. Accordingly, even if the ink cartridge 40 in which an available amount of ink remains is exchanged or the printing apparatus 1 is changed, it is possible to provide control while grasping an optimum remaining ink volume at all times. Consequently, it is possible to prevent troubles such as execution of printing in an out-of-ink state or display of an instruction to exchange an ink cartridge having a sufficient remaining ink volume.

[0120] Furthermore, since an IC card which stores the latest information for each individual customer can be delivered to each customer together with an ink cartridge, the latest information can be provided to the cus-

tomers.

[0121] In addition, since data peculiar to a customer can be stored in the IC chip 61 at the desire of the customer and this IC card 61 can be moved together with the ink cartridge 40, even if the facsimile body 10 provided with the printer 20 is exchanged, the data can be transferred without problem.

FIG. 1	VIEW OF ENTIRE FACSIMILE MACHINE
FIG. 2	BLOCK DIAGRAM OF FACSIMILE MACHINE
10	FACSIMILE
11	CONTACT IMAGE SENSOR
12	COVER SWITCH
13	PAPER SENSOR
14	SCANNER MOTOR
15	KEYBOARD UNIT
16	HANDSET CONTROL UNIT
17	HANDSET
18	NETWORK CONTROL UNIT
19	SPEAKER
20	PRINTER
22	PRINTER BOARD UNIT
30	POWER SUPPLY UNIT
70	IC CARD INTERFACE
FIG. 3	INK CARTRIDGE
FIG. 4	PRINTER
FIG. 5	IC CARD INTERFACE
FIG. 6(a)	IC CARD INTERFACE
FIG. 6(b)	IC CARD INTERFACE
FIG. 7	CIRCUIT DIAGRAM OF INTERFACE
FIG. 8	FLOWCHART OF IC CARD SYSTEM
S10	POWER ON?
S11	INITIALIZATION
S12	PROCESS A
S13	ID VERIFICATION OK?
S14	STOP/ERROR DISPLAY
S16	VOICE COMMUNICATION
S20	IDLE MODE
S21	INCOMING CALL?
S22	START AUTOMATIC TIMER?
S23	PANEL OPERATION?
S24	DATA TRANSFER?
S25	COVER OPEN?
S26	PROCESS C
S30	FACSIMILE COMMUNICATION?
S31	FACSIMILE COMMUNICATION
S32	AUTOMATIC TRANSMISSION?
S33	FACSIMILE TRANSMISSION
S34	AUTOMATIC RECEPTION?
S35	FACSIMILE RECEPTION
S36	AUTOMATIC SERVICE?
S37	COPY PRINTING
S40	TELEPHONE/VOICE?
S41	VOICE COMMUNICATION
S42	COPY PRINTING?
S43	COPY PRINTING
S44	DATA CHANGE?

S45 COPY PRINTING  
 S46 FACSIMILE COMMUNICATION?  
 S47 FACSIMILE COMMUNICATION  
 S48 PROCESS B  
 S49 INK VOLUME < LOW?  
 S50 OUT OF INK?  
 S51 DISPLAY: INK LOW  
 FIG. 9 FLOWCHART OF PROCESS A  
 PROCESS A  
 A10 TRANSFER DATA FROM IC CARD TO SYSTEM MEMORY: PgM McM CcC  
 A11 VALIDATION OF McM and CcC?  
 A14 DISPLAY: CARTRIDGE ERROR  
 A15 DISABLE PRINTER FUNCTION  
 IDLE MODE  
 DEFINITIONS (IC CARD MEMORY)  
 PgM = PAGE COUNT MEMORY  
 {Pg} = ACTUAL NUMBER OF PAGES AVAILABLE  
 {Pi} = LOW INK MARK  
 {Po} = OUT OF INK MARK  
 McM = MACHINE CODE  
 CcC = CUSTOMER CODE  
 FIG. 10 FLOWCHART OF PROCESS B  
 PRINT JOB FINISHED PROCESS B  
 B10 COPY PRINTING PROCESS?  
 B11 LATEST CONSUMPTION DATA OF IC CARD MEMORY  
 B12 CALCULATE CONSUMED INK VOLUME RELATIVE TO PAGES (SUBROUTINE A)  
 B13 TRANSFER DATA FROM SYSTEM MEMORY TO IC CARD  
 B16 DISPLAY: CARTRIDGE ERROR  
 B17 DISABLE PRINTER FUNCTION  
 IDLE MODE  
 DEFINITIONS (IC CARD MEMORY)  
 PgM = PAGE COUNT MEMORY  
 {Pg} = ACTUAL NUMBER OF PAGES AVAILABLE  
 {Pp} = NUMBER OF PAGES PRINTED DURING ONE PRINT JOB  
 {Pi} = LOW INK MARK  
 {Po} = OUT OF INK MARK  
 McM = MACHINE CODE  
 CcC = CUSTOMER CODE  
 FIG. 11 FLOWCHART OF PROCESS C  
 PROCESS C  
 C10 USER INTERFACE ROUTINE  
 C11 SELECT "NO SELECTION"?  
 C12 READ FROM IC CARD?  
 C13 WRITE SELECTED DATA FROM IC CARD TO SYSTEM MEMORY  
 C14 WRITE TO IC CARD?  
 C15 WRITE SELECTED DATA FROM SYSTEM MEMORY TO IC CARD  
 IDLE MODE  
 DEFINITIONS (MEMORY AREAS)  
 {ID} = ID NAME

{IN} = ID NUMBER  
 {DD} = DIAL DIRECTORY  
 {ST} = STATISTIC (ONLY IN SERVICE MODE) SELECTION  
 5 {NULL} = NO SELECTION

### Claims

1. A printing apparatus which includes an inkjet printer and is arranged to supply an ink for said inkjet printer from an exchangeable ink cartridge, comprising:

an interface provided in said printing apparatus, for reading information from an IC chip secured to an IC card which accompanies said ink cartridge, said IC chip having a read only memory and a read/write memory, a control signal for starting an operation of said inkjet printer being stored in said read only memory,

information indicative of a final printing date/time of said inkjet printer being stored in said read/write memory,

wherein said printing apparatus is controlled to start said inkjet printer when reading said control signal from said read only memory, and wherein when a predetermined time elapses from the final printing date/time read from said read/write memory, said printing apparatus is controlled to operate said inkjet printer to perform printing in a predetermined format, and update the final printing date/time of said read/write memory.

2. A printing apparatus which includes an inkjet printer and is arranged to supply an ink for said inkjet printer from an exchangeable ink cartridge, comprising:

an interface provided in said printing apparatus, for reading information from an IC chip secured to said ink cartridge, said IC chip having a read only memory and a read/write memory,

a control signal for starting an operation of said inkjet printer being stored in said read only memory,

information indicative of a final printing date/time of said inkjet printer being stored in said read/write memory,

wherein said printing apparatus is controlled to start said inkjet printer when reading said control signal from said read only memory, and wherein when a predetermined time elapses from the final printing date/time read from said read/write memory, said printing apparatus is controlled to operate said inkjet printer to per-

form printing in a predetermined format, and update the final printing date/time of said read/write memory.

a transmission function of said facsimile machine without stopping the transmission function.

3. A printing apparatus including an inkjet printer according to claim 1 or 2, further comprising consumed-ink-volume detecting means for detecting a consumed ink volume relative to a print job, and remaining-ink-volume detecting means for detecting a remaining ink volume of said ink cartridge mounted on said inkjet printer from the consumed ink volume detected by said consumed-ink-volume detecting means, said printing apparatus being arranged to update said read/write memory and store in said read/write memory the remaining ink volume detected by said remaining-ink-volume detecting means, the remaining ink volume varying with the print job of said printing apparatus, and issue a warning when the remaining ink volume becomes smaller than a predetermined ink volume, and then stop said printer after causing said printer to perform a predetermined quantity of printing.
4. A printing apparatus including an inkjet printer according to one of claims 1 to 3, wherein information indicative of an operation guide for said printing apparatus and setup information for at least one of said printing apparatus and said inkjet printer are stored in said read only memory of said IC chip.
5. A printing apparatus including an inkjet printer according to one of claims 1 to 4, wherein at least one kind of information for each individual customer is stored in said read only memory of said IC chip, said at least one kind of information being selected from among language selection information, control information as to a machine operation such as setup which conforms to standards of each country, an instruction manual of said printing apparatus, service information as to expendable supplies, and guidance information as to a maintenance service network.
6. A printing apparatus including an inkjet printer according to one of claims 1 to 5, wherein information exclusive to a customer, which includes at least either information representative of a relation between offices with which the customer communicates and their shortened telephone numbers or an emergency telephone number for the customer, is stored in said read/write memory.
7. A printing apparatus including an inkjet printer according to one of claims 1 to 6, wherein said printing apparatus is a facsimile machine and, when the control signal for starting the operation of said inkjet printer is not inputted from said read only memory, stops only a printer function and maintains

FIG.1

VIEW OF ENTIRE FACSIMILE MACHINE

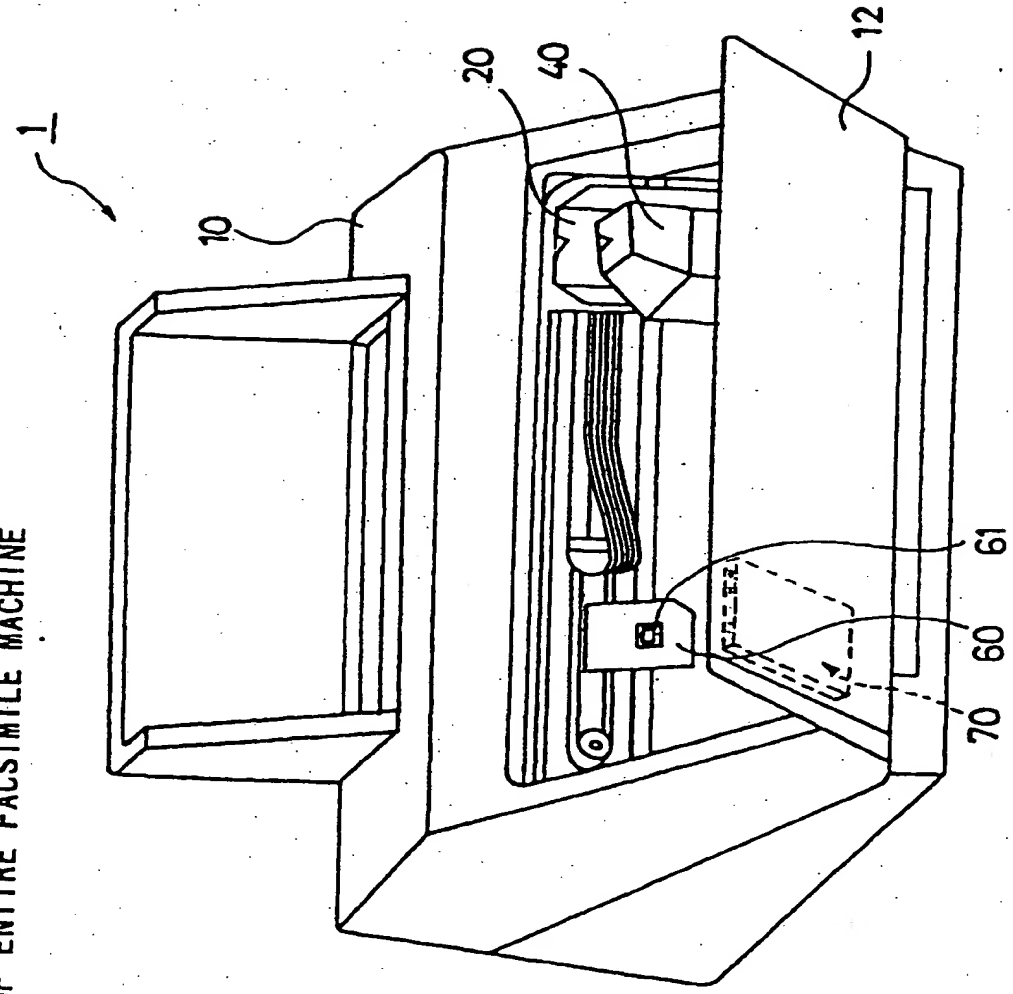


FIG.2

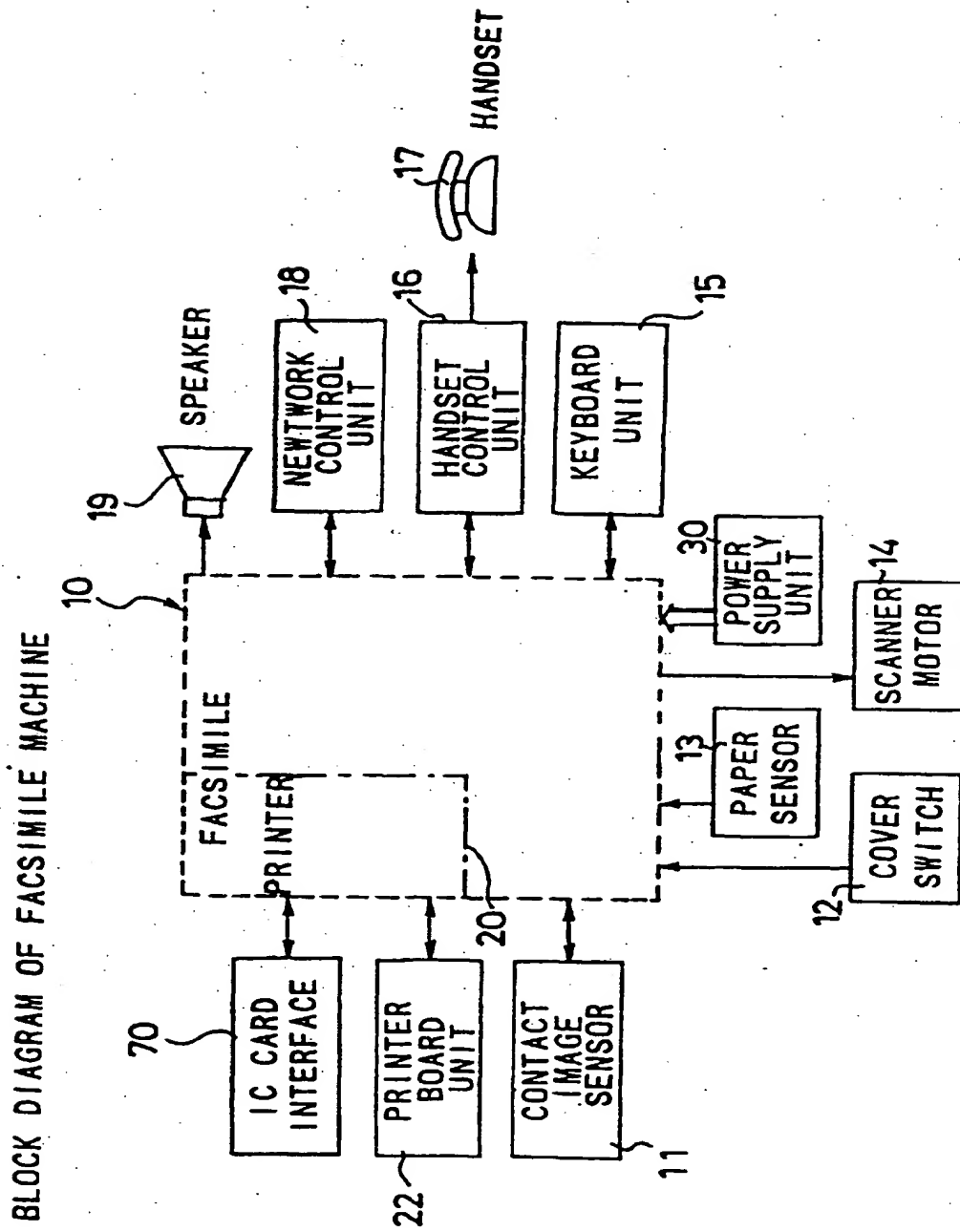


FIG.3

INK CARTRIDGE

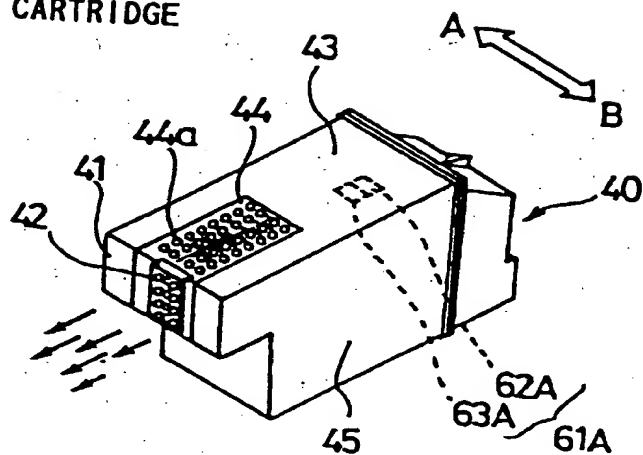


FIG.4

PRINTER

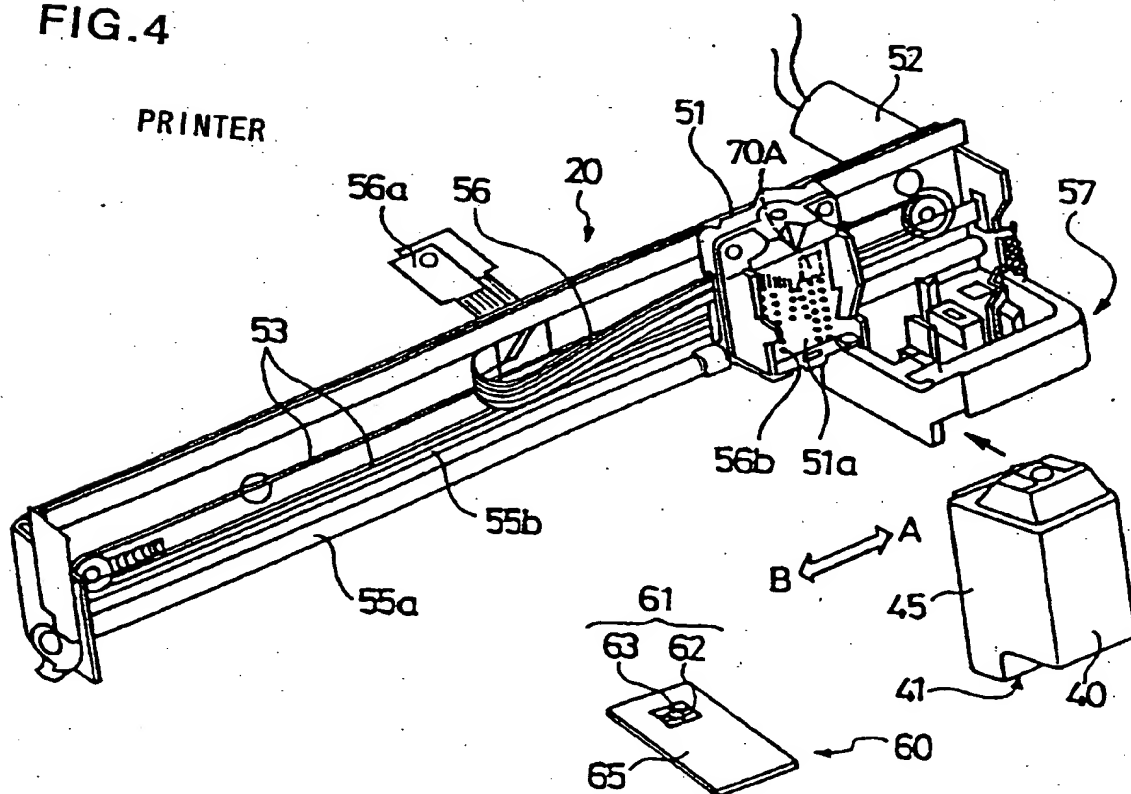


FIG.5

IC CARD INTERFACE

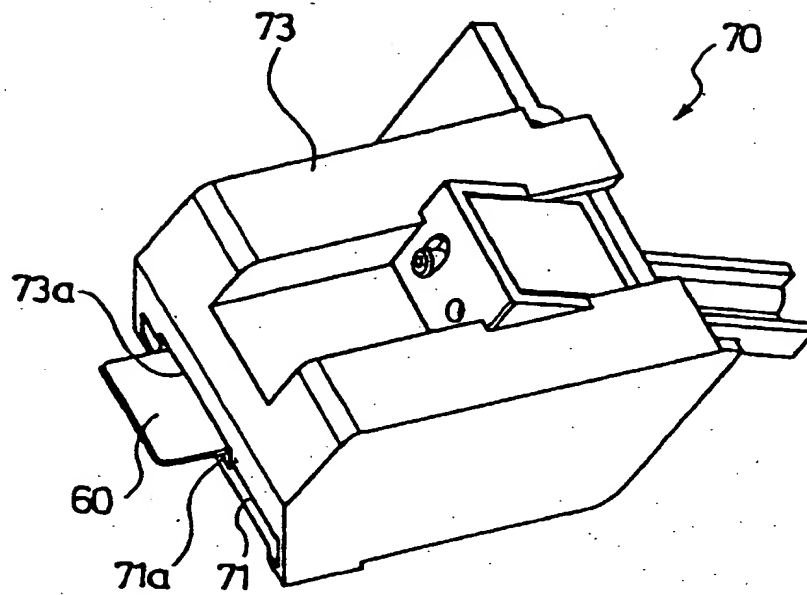




FIG.6 (a)

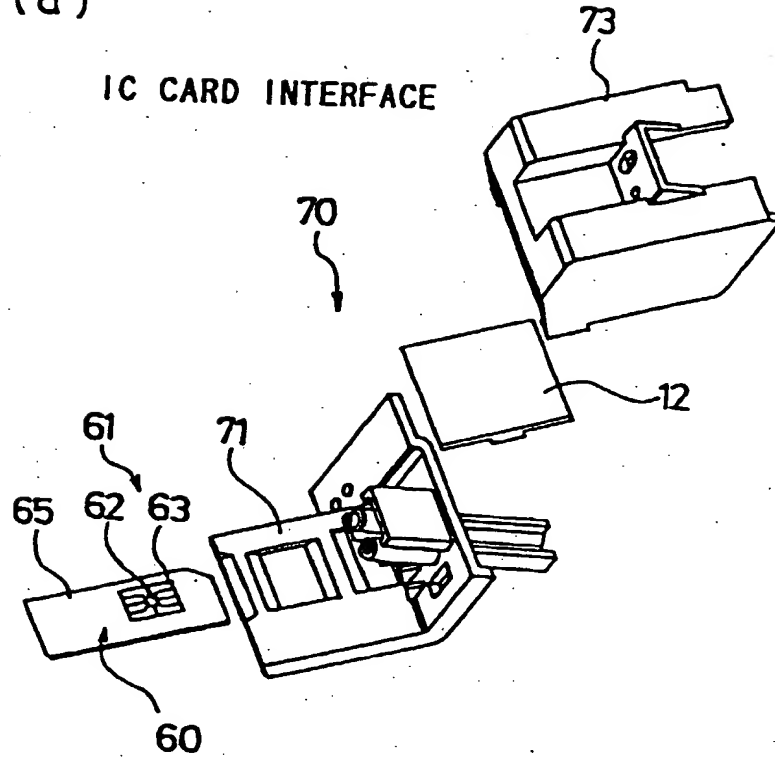


FIG.6 (b)

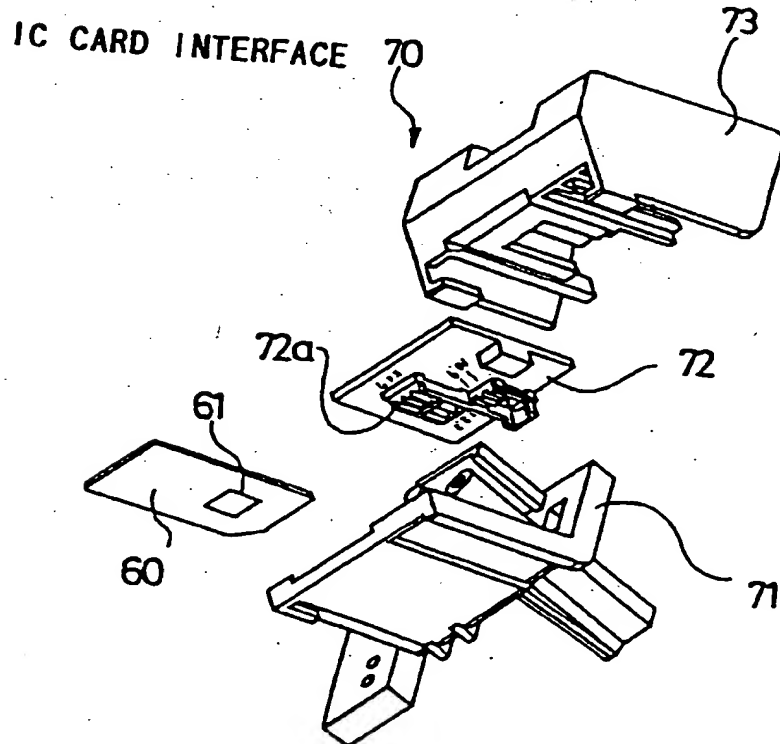


FIG.7

CIRCUIT DIAGRAM OF INTERFACE

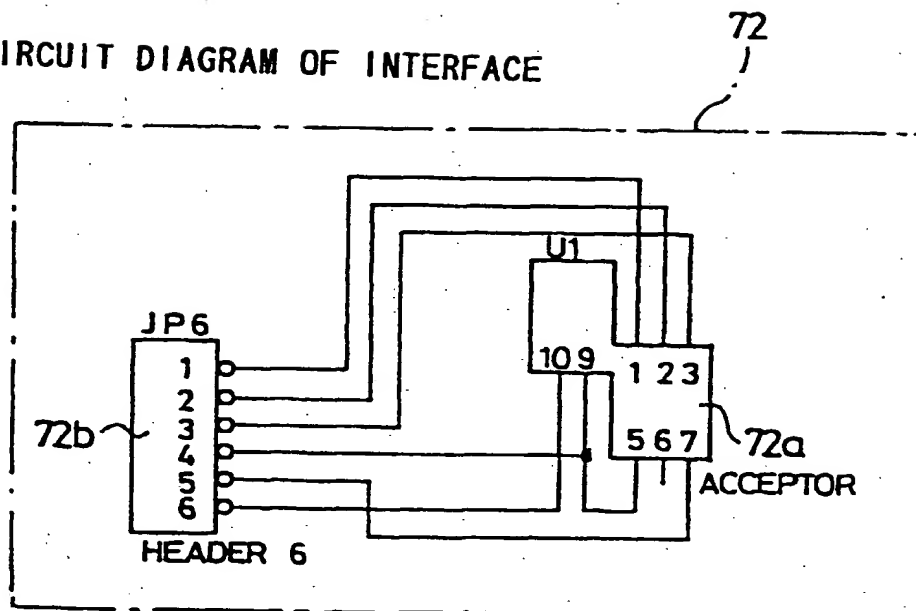


FIG.8  
FLOWCHART OF IC CARD SYSTEM

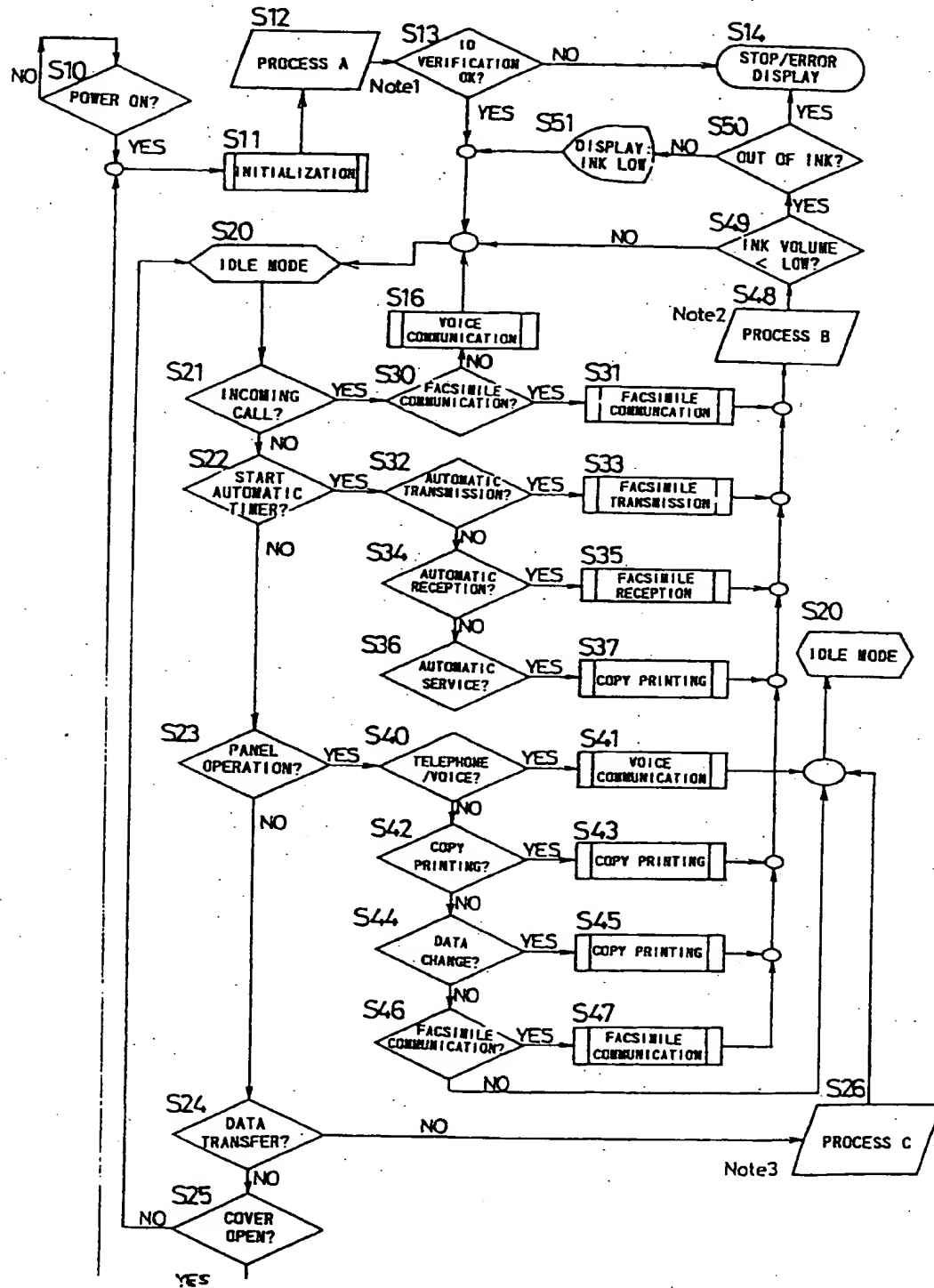


FIG.9

## FLOWCHART OF PROCESS A

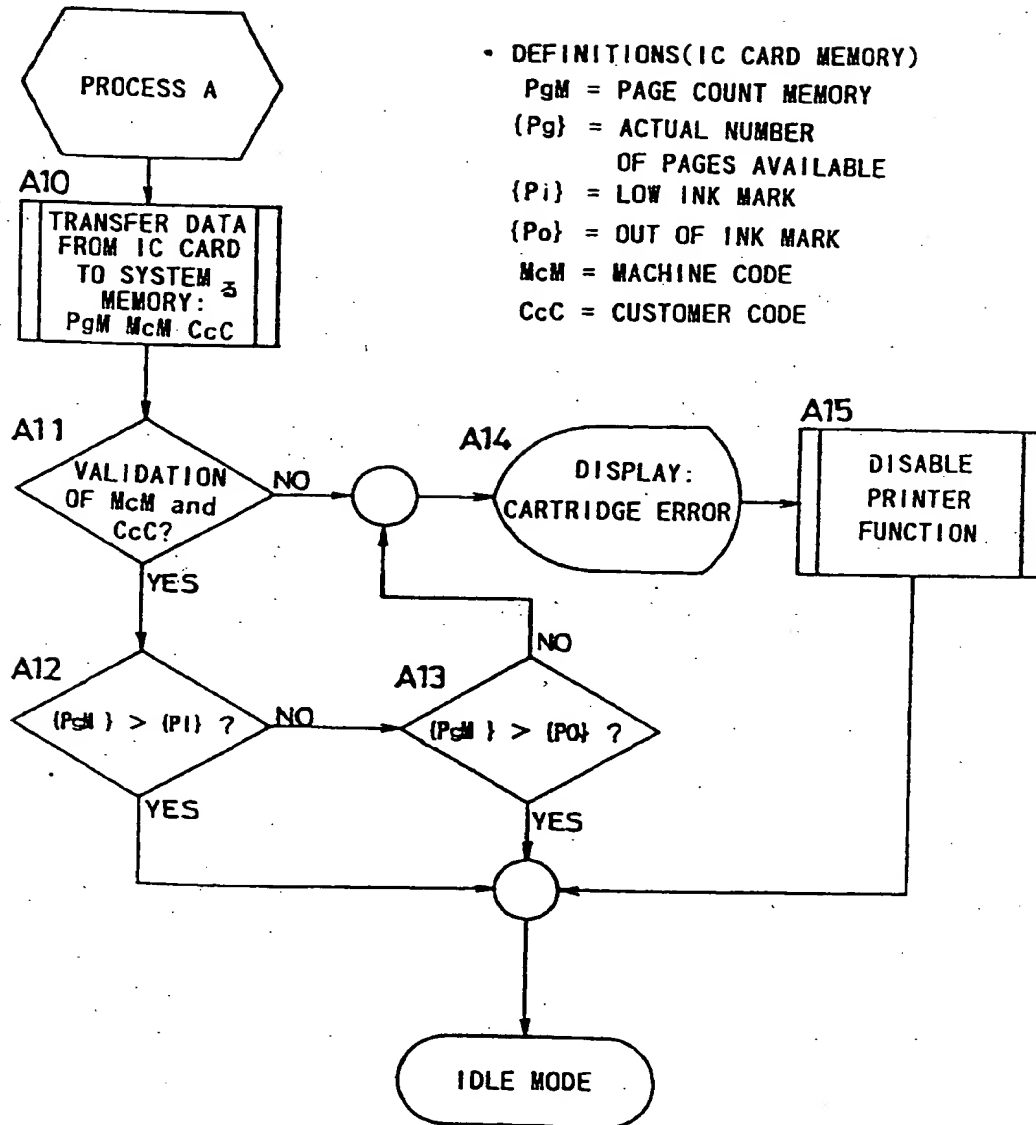


FIG.10

## FLOWCHART OF PROCESS B

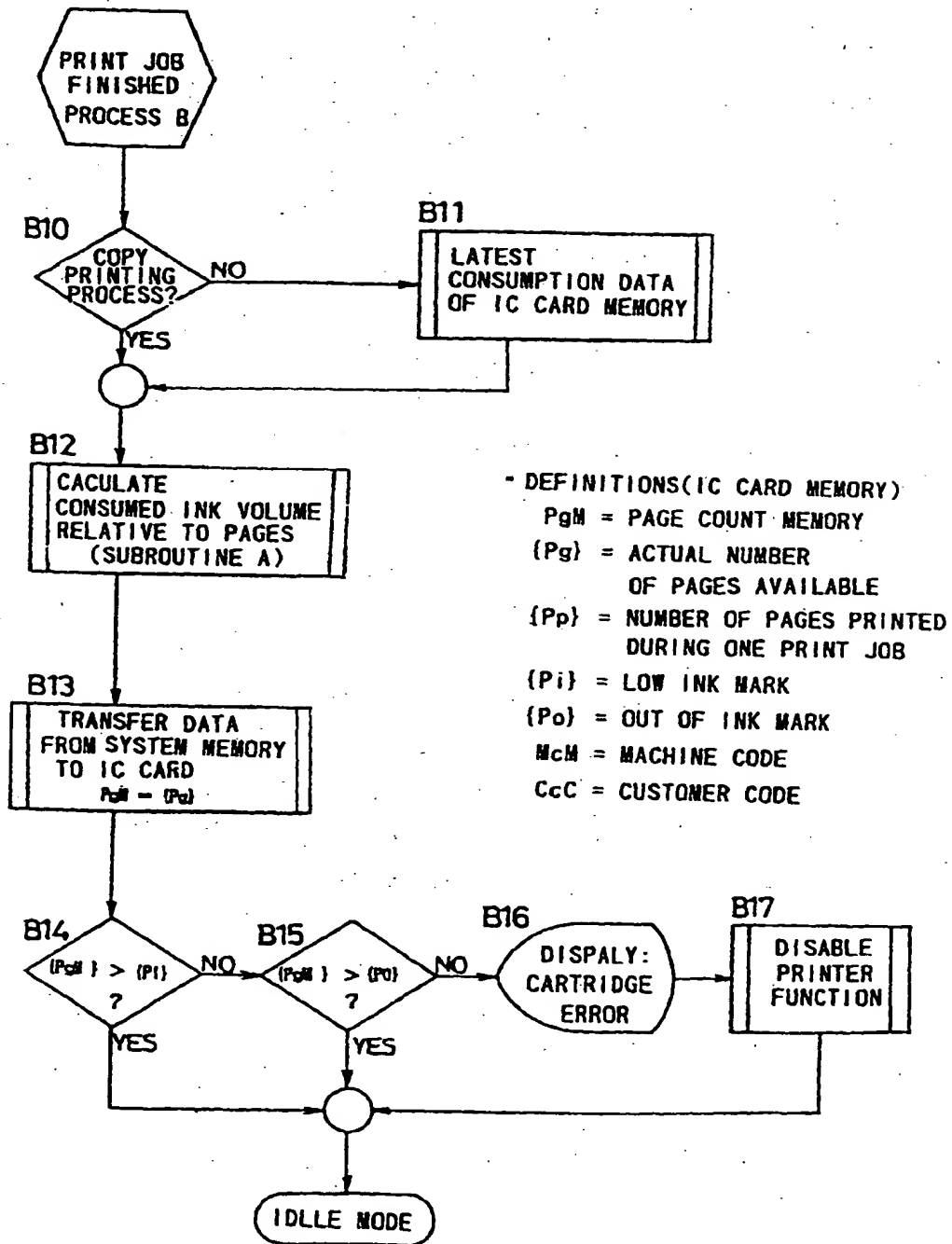


FIG.11

## FLOWCHART OF PROCESS C

